SUBMISSION TO ESSENTIAL SERVICES COMMISSION INQUIRY INTO THE TRUE VALUE OF DISTRIBUTED GENERATION – Proposed Approach Paper

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Summary

The approach proposed by the ESC to evaluation of the 'true value' of Distributed Generation (DG) is inadequate. Further, the ESC has not demonstrated that its approach will identify and analyse the multiple benefits of DG because it focuses on 'easily quantifiable' factors and shows a bias towards impacts on the incumbent electricity industry instead of a comprehensive societal perspective. To some degree these problems result from limitations in the wording of the Terms of Reference of the Inquiry, and from the objectives of the ESC Act, which frames the culture and approach of the ESC.

There is a strong case for the government to reconsider who should implement this Inquiry, and it should also review the ESC Act.

As part of the Inquiry, the ESC must analyse the allocation of revenue from on-selling of electricity exported by DG hosts to ensure it is fair. DG hosts must be treated fairly, in terms of tariffs, fees and charges and operational issues, relative to other consumers with features that also impact on energy supply infrastructure costs, such as users of large air conditioners, gas-connected households etc.

It is critical that evaluation of 'true value' comprehensively addresses all costs and benefits that affect consumers in the long term. The ESC focuses too much on impacts on the incumbent electricity supply industry and on 'easily quantifiable' other factors.

It is pleasing to see the ESC includes storage in its interpretation of DG. However, DG (including energy storage) cannot be evaluated separately from many other factors in an increasingly complex system. It is the marginal impact of changes in demand and exports to neighbours on costs of energy supply and societal impacts that matters, not the specific technologies installed. For example, a combination of energy efficiency improvement and energy storage could have a significant impact on the demand profile of a consumer and export of electricity while still reducing their overall electricity consumption. Thermal storage is also an alternative to electricity storage in some circumstances: ESC does not make it clear what types of storage it will consider.

The impact of choices (both past and future) made by network providers regarding infrastructure on costs and benefits of DG should also be explored, so that the level of responsibility they have for adapting to DG and other changes to achieve 'least societal cost' outcomes becomes clear.

The focus of analysis of impacts on the electricity system should be on the impacts of incremental higher or lower demand and export on the grid under a range of circumstances, particularly at times and locations when and where the grid is under stress.

ESC should aim to develop a flexible, user friendly model that can be used to evaluate a wide range of circumstances and assumptions, and determine impacts, costs and benefits. This model should be made freely available so consumers can engage with energy policy makers and others.

It is surprising that the ESC has been unable to identify environmental or other public benefits from DG (p.v). This submission provides some examples of the kinds of factors that are relevant, and some sources of information.

Given rapid changes in technologies (including electric vehicles), business models and climate policy, the ESC needs to consider the broader market context when assessing how to evaluate the 'true value', not just in today's conditions, but in foreseeable future circumstances.

The principles (or criteria) used to determine the value of DG as proposed by the ESC seem sensible in theory but, if applied only to DG and not to existing market participants, will place an unfair burden on DG. Application of the criteria must consider the context and rules applied to others.

Terms of Reference (from the ESC paper)

The government's Terms of Reference request the Commission to:

 Examine the value of distributed generation including: the value of distributed generation for the wholesale electricity market; the value of distributed generation for the planning, investment and operation of the electricity network; and the environmental and social value of distributed generation.

 Assess the adequacy of the current policy and regulatory frameworks governing the remuneration of distributed generation for the identified value it provides.

 Make recommendations for any policy and/or regulatory reform required to ensure effective compensation of the value of distributed generation in Victoria.

The ESC proposes to include within the scope of its work DG systems under 5 MW, all forms of DG including storage, and all generation including for onsite use as well as export.

Introduction

I do not consider the ESC's proposed approach to be adequate to meet the Terms of Reference. The framing of the analysis is inadequate. However, I recognise that the ESC is limited by some inadequacies in the framing of its Terms of Reference, as well as the legislation under which it operates. So it may be necessary to seek amendment of the ToR and/or to propose further work, possibly by others. This submission explores why the proposed approach is inadequate and suggests some ways of improving it.

Quantification versus Consideration in this Inquiry

The use of the phrase 'easily quantifiable' (pages iv, v and 19) suggests that the ESC does not intend to carry out a comprehensive analysis that I believe is a Government expectation. This means it will fall into the same trap as other Inquiries, by making superficial judgements and applying a discriminatory approach by setting costs or benefits that are 'too difficult to analyse with existing data' to zero value or to extremely 'conservative' values that discriminate against DG, as VCEC did in its 2012 FiT Inquiry.

A comprehensive assessment is required. Where existing data or methodologies are inadequate to evaluate and quantify a factor, a number of approaches can be used:

- First, the issue must be explored and clearly explained
- A range of plausible assumptions can be used to produce 'high' and 'low' estimates of value to explore the significance of the issue and guide further evaluation – sensitivity analysis. Consultation may be required to confirm the interpretation of the issue, and to establish the range of values
- Further work can be done to collect data and/or develop an appropriate methodology so that the issue can be incorporated into ESC's evaluation
- Where data collection or methodology development would require more time or resources than available within this Inquiry, a workplan (including preliminary budget) should be prepared and included in recommendations
- Where an issue cannot be quantified, it should be clarified and explored using qualitative approaches, such as Cost Effectiveness Analysis (see below) that will support its proper consideration by decision-makers.

Guidelines for development of public policy clearly require policy makers to address issues that are difficult or even impossible to quantify. For example, the CoAG Guidelines (*Best Practice Regulation A Guide For Ministerial Councils And National Standard Setting Bodies* (October 2007) make it clear that inability to quantify a factor should not mean it is ignored. For example, the Guidelines (p.21) state:

> "Inevitably, some costs and benefits resist the assignment of dollar values. Known as 'intangibles', these are separately presented to decision-makers for assessment in conjunction with those that can be quantified."

The CoAG Guide also notes (p.22):

> "CBA [Cost Benefit Analysis] can provide guidance on the implications of regulatory activity, where there are grounds for mistrusting the signals provided by market prices or where no markets exist. CBA is also helpful where regulations impose 'spillover' costs or benefits on third parties. Often these do not receive due recognition because no formal market transactions take place. Through the use of shadow prices, values can be placed on non-market 'spillover' effects (for example, pollution, safety) and compared with market transactions.
>
> Examples where the signals that market prices normally provide are either absent or fail to reflect the true costs of regulatory action arise when valuing:
> • intermediate goods - such as savings in travel time resulting from transport regulations;
> • 'externalities' - or unmarketed positive or negative spillover effects such as arise from pollution, vaccination programs or banning a dangerous product;
> • goods affected by taxes and subsidies; and
> • labour in the presence of unemployment.
>
> "The main practical constraint to using CBA is the feasibility and appropriateness of assigning money values to the costs and benefits generated by government action. In circumstances where these constraints are overwhelming, cost-effectiveness analysis is frequently a viable alternative approach."

Cost-effectiveness analysis is not a widely used term in Australian policy circles. Wikipedia (https://en.wikipedia.org/wiki/Cost-effectiveness_analysis) defines it as follows:

> **Cost-effectiveness analysis** (**CEA**) is a form of economic analysis that compares the relative costs and outcomes (effects) of two or more courses of action. Cost-effectiveness analysis is distinct from cost–benefit analysis, which assigns a monetary value to the measure of effect.[1] Cost-effectiveness analysis is often used in the field of health services, where it may be inappropriate to monetize health effect. Typically the CEA is expressed in terms of a ratio where the denominator is a gain in health from a measure (years of life, premature births averted, sight-years gained) and the numerator is the cost associated with the health gain.[2] The most commonly used outcome measure is quality-adjusted life years (QALY).[1] Cost-utility analysis is similar to cost-effectiveness analysis. Cost-effectiveness analyses are often visualized on a cost-effectiveness plane consisting of four-quadrants. Outcomes plotted in Quadrant I are more effective and more expensive, those in Quadrant II are more effective and less expensive, those in Quadrant III are less effective and less expensive, and those in Quadrant IV are less effective and more expensive.[3]

If ESC is to provide a credible assessment of the true value of DG, and resolve instead of inflame conflict, it will need to demonstrate that it has adopted a comprehensive approach to identification and evaluation of issues. It will also need to provide input to policy makers on issues that are difficult

to quantify as well as transparent explanation of the assumptions and uncertainties underpinning factors it does quantify. My understanding is that this is the underlying intent of the government.

A Core Question

There is a fundamental issue to be resolved regarding the allocation of revenue from on-selling of electricity exported by a Distributed Generator. ESC may see this as outside its ToR but, if it is not addressed, the Inquiry will fail to achieve a useful outcome.

A DG host may, for example, be paid 5 cents/kilowatt-hour for electricity exports. But this electricity is then sold to another (usually nearby) consumer at the full retail price, typically 15 to 35 cents. At present, the gap between the export price and the on-selling price is captured by the retailer and network operator, even if they incur very small costs and only a small part of the network is utilised.

ESC must compare actual costs incurred by the retailer and network operator relative to this price difference, and **ensure that they do not gain windfall profits at the expense of the DG host**. There seems to be a case for the DG host to be paid a much larger share of the on-selling price under most circumstances. Resolution of this issue is fundamental to the evaluation of the 'true value' of DG.

Further, a DG host is generally required by its retailer to agree to a Time of Use tariff, while other consumers are not required to. This means any net power consumption between 7am and 11pm on weekdays in Victoria costs a DG host much more than it would if the DG was on a similar tariff to other consumers, although prices are lower at other times.

This is discriminatory unless the DG host has the same choices as other consumers with similar impacts on the electricity supply system. For example, why are owners of large air conditioners not required to be on a TOU tariff like DG hosts? There is a secondary issue here, relating to the crude and disempowering design of the TOU tariff used widely by Victorian energy retailers, with a high price from 7am to 11pm on weekdays. In NSW, the common structure of the TOU pricing allocated the highest prices to mid-afternoon and early evening usage, so there is far more scope for consumers to adjust their behaviour to minimise costs. I note that the Victorian government seems to have a preference for an improved TOU tariff structure.

'True Value' should not be based on value of savings to the electricity supply industry

The issue of discrimination is even broader than outlined above, and comes to the ESC's core assumption that the 'true value' of DG must be largely based on how much money it saves its competitors, the electricity retailers, network operators and generators.

While air conditioning is often used as an example of this discrimination, there are other useful examples. For example, it could be argued that many energy efficiency measures impact (both beneficially and adversely) on the electricity demand profile and profitability of the electricity supply industry, as their impact is linked to the times when they reduce demand. For example, energy efficient residential lighting helps to reduce early evening peak demand. An economy cycle on a commercial building cuts demand in cooler weather but can actually increase peak demand in hot weather, as HVAC will have to work harder when switched on after indoor temperatures reach the threshold temperature at which active cooling takes over from ventilation, which is often higher than the set point for the air conditioning.

Over the past few decades, the gas industry has had a major impact on the profile of demand for electricity through its replacement of electric off-peak hot water services by gas HWS units across most of Victoria. This has created a significant issue for an electricity industry heavily dependent on

inflexible base load brown coal generators. It has potentially contributed to the 'need' for massive investment in interstate electricity connections. The gas industry was never expected to compensate the electricity industry for its impact on their costs, nor was the 'true value' of gas based on what it saved the electricity industry.

Solar hot water systems with electric boosting also have a significant impact on electricity demand profiles. This impact also varies from day to day and seasonally. Yet this activity does not attract calls to assess its 'true value'.

Another example of interest from another sector is the emergence of mobile phone networks. Their developers have not had to pay compensation to Telstra for loss of utilisation of its land-line network.

This issue arises because of the deeply seated assumption built-into our electricity market culture, policy and regulatory frameworks that electricity networks are natural monopolies, and that they are 'entitled' to recover their costs (and make very generous profits given their low level of risk), even when these costs have been incurred as a result of short-sighted, self-interested decisions often based on exploiting the poor design of our regulatory system and the weakness of regulators.

A further assumption is that the incumbent electricity industry is the 'legitimate industry'. Emerging options are all treated as foreign invaders that are grudgingly given partial exemptions or resisted. For example the introduction of a fair system for demand-side bidding has been a 'glacial' process, to use the Productivity Commission's term from its 2013 report on electricity networks.

The submission by Northern Alliance for Greenhouse Action to the 2015 ESC and government inquiries (ESC: *Modernising Victoria's Energy Licence Framework Issues* Inquiry and DEDJTR: *Review of the General Exemption Order Issues* Inquiry) highlighted this unbalanced and piecemeal approach to emerging energy service solutions. It potentially fails to ensure consumer protection in a diversifying energy services industry, while also failing to provide fair treatment of emerging energy options. NAGA questioned the piecemeal use of partial exemptions from market rules and proposed creative alternatives based on models for consumer protection such as third party car insurance.

This issue is driven to some extent by the culture of the energy sector, and partly by the wording of the ESC Act, where incumbents are defined as 'regulated industries' but emerging competitors are not, as discussed below.

Constraints on ESC due to the ESC Act

The ESC Act creates an artificial separation between the industries the ESC regulates, whose financial viability it must protect, and other industries that also have significant influence on the 'long term interests of consumers' (the core objective of the ESC), who are treated as 'a problem'. Indeed, the Act effectively requires the ESC to block growth of industries and activities that undermine the financial viability of the incumbent industry: quite bizarre.

The Act also focuses on 'price, quality and reliability of essential services': it is the total cost to consumers and society that really matters, not the price per unit of energy. This has been widely recognised since the 1970s, when US energy efficiency guru Amory Lovins declared that people want cold beer, not energy. Unfortunately, the energy market reform process has failed to grasp this fundamental concept over the past 20 years, to the cost of consumers.

The Act also only requires the ESC to consider 'relevant health, safety, environmental and social *legislation applying to the industry*' – not broader aspects of these issues and government policies.

Given the constraints of the ESC Act, the appropriateness of the ESC conducting this Inquiry under its present Act should be questioned.

The ESC must provide an explanation of why DG is being singled out for special, discriminatory treatment. Or it must propose a more comprehensive approach so that DG is treated fairly relative to other forms of energy service delivery that change marginal demand profiles. The issue of fairness is discussed in broader terms later in this submission.

One interesting option could be for the government to make emerging energy service suppliers 'regulated industries' under the ESC Act. The ESC would then have to treat all options in a balanced way, and ensure the financial viability of all of them!

Distributed Generation Cannot be Evaluated Separately from Other Energy Service Solutions

Australian energy policy makers, and the industry itself, are still labouring under a misapprehension: in reality, people do not want energy for its own sake. They want the services to which it may be an input: the amount, timing and type of energy required is influenced by technology, cultural factors, purchase costs of equipment, etc.

Consumers face an increasing range of options to use less energy, or to use different forms of energy and energy technologies to deliver these services. Until energy policy is based on energy services, policy will continue to fail to meet community expectations.

In my recent presentation to APEC energy ministers at their Philippines conference in October 2015, I presented the model shown in Figure 1. This is an attempt to illustrate the true nature of the 'energy service delivery' system, and the complex and interactive roles that many technologies and business factors play in it.

As the ESC partly acknowledges, the actual avoided cost (only one element of the true value) of DG is dependent on timing and location of the DG. But this is a small part of the issue. If we are concerned about understanding the cost impacts of DG on the existing incumbent electricity industry, we must recognise that emerging alternatives can be applied at many different points in the system. They interact in complex ways to influence the demand profile, location of demand and ongoing trends, and compete in a range of markets, some only distantly related to energy in the eyes of their participants, such as the building and appliance industries. Some alternatives, such as DG and storage, also have the potential to reverse the flow of electricity in parts of the grid.

The emergence of energy storage, which can also export or import electricity, and can shift the timing of import and export of electricity, is another challenge that must be factored into the ESC's considerations (as ESC has proposed), as it can manage the timing and scale of impacts on the electricity demand profile seen by the existing electricity supply system. However, the role of storage can go well beyond simply storing electricity generated by DG.

Storage also can impact on the 'value' of energy efficiency, demand management and other options by shifting the timing and scale of their impact on the electricity supply system: this can include increasing exports at times when it helps the electricity system cope, as well as allowing consumers with storage to 'charge up' at times of low prices and export when prices are high, and they could be seen to 'help' the network and generation system to cope with extreme demand or manage supply system failures. Storage and smart controls can also provide ancillary services to assist the grid.

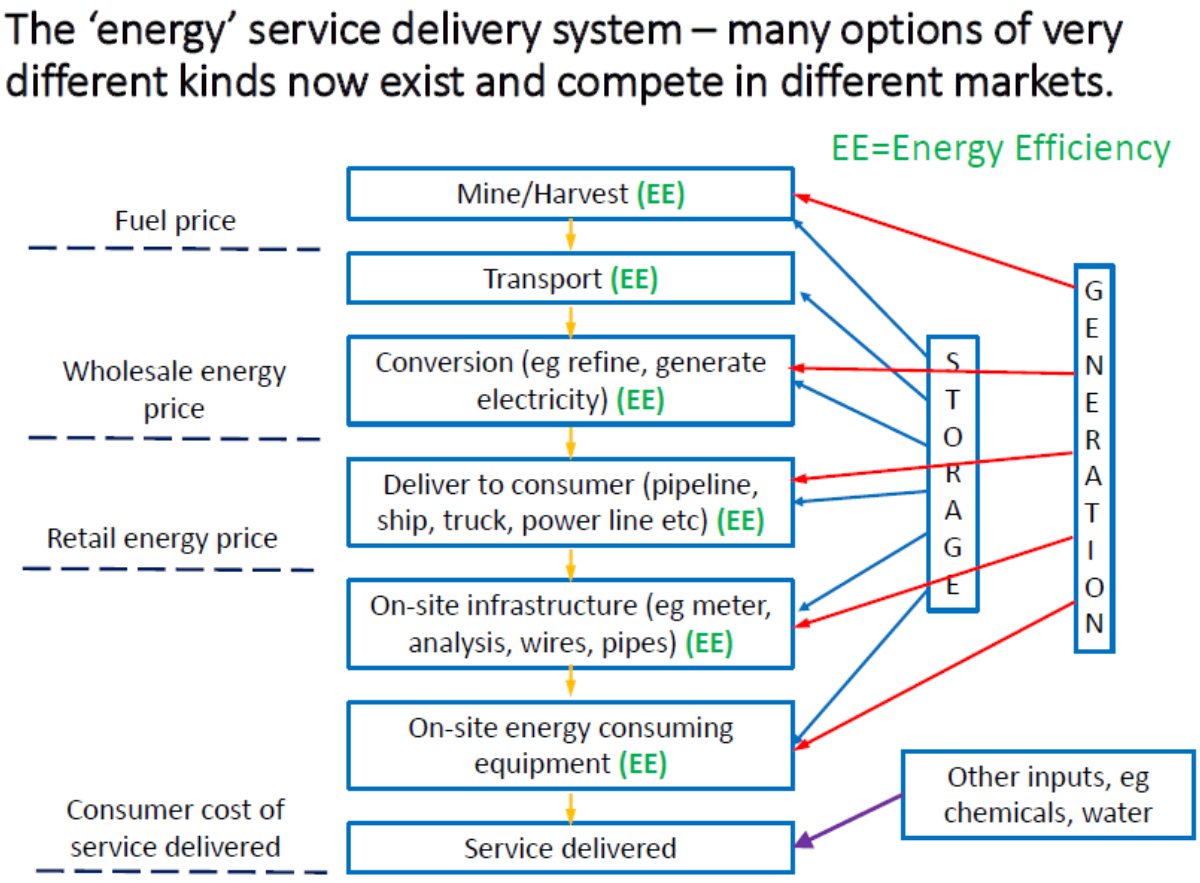
This converts energy efficiency savings into electricity export and ancillary services potential. For example, a consumer could buy an energy efficient refrigerator and store the saved energy in a battery, then export that energy (minus storage cycle losses) at times when it is profitable, without increasing its overall electricity consumption.

Thermal storage can play a similar role to battery storage. By storing heat or 'coolth' the need to run electric heating, hot water or cooling equipment at specific times can be managed.

We are also seeing emerging business services to allow small DG hosts to bid into wholesale electricity markets: this allows them to profit when prices are high (a private benefit) but also has the effect of reducing peak wholesale electricity prices and avoiding need for network capacity.

If clear incentives are created to provide smart management systems, demand side bidding and other options, new business models will emerge that accelerate change by making it cheaper and easier for DG hosts *and other consumers* to manage demand and export electricity.

Figure 1. The energy services supply system (Pears, Oct 2015 presentation at APEC Energy Ministers Conference, Cebu-Mactan, Philippines)



Unless the ESC models this complex system, and focuses on the costs and benefits of marginal changes to the half-hourly demand profile and location of demand, the impact on network utilisation of exports to nearby neighbours, and the potential economic benefits of new business models and technologies, it will not be able to estimate the this element of the 'true value' of emerging technology impacts on the costs and profits of the incumbent industry. And, of course, this is just one part of the 'true value' of DG.

Electric vehicles add an extra dimension to this complexity, by providing potentially high demand when charging, but also offers 'portable storage' that could be used to export or import electricity without reliance on the grid.

An Appropriate Framework

In estimating the value of distributed generation (DG), it is necessary to recognise several issues:

- Depending on the DG technology and generation profile relative to local, regional and system level demand, as well as a range of contextual factors (eg bush fire risk, level of stress and age of existing energy supply infrastructure, line losses etc) the costs and benefits of DG can vary enormously. ESC acknowledges (on p.iv) the significance of timing and location on wholesale electricity prices, but fails to acknowledge that this applies even more to grid (network and transmission) costs, overall economic efficiency and social costs.
- In terms of impacts on the electricity grid, DG can be similar to a range of other technologies such as energy efficiency measures, demand management techniques, and consumer use of high demand equipment. A key difference is that DG can do more than reduce or increase demand at a given time: it can also export electricity. However, as discussed earlier, demand management, storage and other techniques and DG can avoid placing loads on the grid at critical times, and can even export to the grid at those times. The use of combinations of approaches is becoming increasingly feasible and amplifies potential benefits
- If appropriate incentives are offered or requirements specified, potential adverse impacts of DG on the grid can be reduced, avoided or even converted into benefits *if* network operators select appropriate technologies and encourage complementary user behaviour. It is important for ESC to consider mechanisms that will encourage (or require) network operators to support innovation that delivers long-term consumer benefits, not just focus on their own interests. Failure of a network operator or retailer to pursue such actions should not be used to justify passing costs that result on to consumers: networks must be accountable for their actions or lack of action.
- Costs and benefits of DG beyond its impacts on the existing electricity supply system must also be thoroughly considered (see below).

Given these circumstances, it is inappropriate to draw an arbitrary distinction between a DG host and the demand profiles of other consumers.

The focus of analysis of impacts on the electricity system should be on the impacts of incremental higher or lower demand and export on the grid under a range of circumstances, particularly at times and locations when and where the grid is under stress. Such analysis should also evaluate the extent to which network operators could have been reasonably expected to take actions that would have reduced or avoided those costs.

Recommendations should be applicable to any consumer (including DG hosts connected to the grid), based on the nature of their impacts, not what technologies they have or use. Clearly it would be very difficult to propose pricing structures that accurately reflect all possibilities. But the initial analysis should aim to develop a comprehensive understanding of the full range of situations, so that distortions created as simplified approaches are applied can be understood and managed by complementary measures (such as separate incentives, regulatory requirements, specification of technology characteristics, complementary actions, etc).

ESC should aim to develop a flexible, user friendly model that can be used to evaluate a wide range of circumstances and assumptions, and determine impacts, costs and benefits. This model should be made freely available so consumers can engage with energy policy makers and others.

The approach must also consider a number of dimensions of fairness to the DG host (and other consumers) regarding:

- Where a DG host has lower consumption of grid-sourced electricity, their treatment should be comparable to treatment of small households, those who adopt energy saving measures and other 'lower than typical' consumers such as those connected to gas
- Where the size of a consumer's peak demand is higher, lower or more variable than other consumers at times of coincident local and/or regional peak demand, DG hosts must be treated in ways comparable to consumers who apply demand management techniques or, conversely, consumers with high coincident peak demand
- Where groups of consumers work together to manage their overall demand on the grid, whether or not they are DG hosts, their treatment should be guided by common principles
- Fair allocation of revenue from sale of exported electricity to other consumers between the DG host, energy retailer, network operator and any other relevant agents must be achieved
- Avoidance of technology-specific fees, charges and payments: these should be applied to all consumers based on common principles that reflect their independently verified impacts on the grid or safety considerations
- Levels of fees and charges must be fair for inspections and other actions, and mechanisms must be implemented to ensure they are properly carried out by relevant agents.
- The level of fixed charges and/or other unavoidable costs, such as ongoing charges based on capacity of a connection rather than the actual demand, for all consumers must be set at a low level. Economic policy makers argue that pricing should reflect long run marginal costs. In contrast, high fixed charges focus on recovery of sunk costs and financial risk reduction for the electricity industry at the expense of sending clear pricing signals to consumers.
- Consideration of what responsibilities network operators have to identify and pursue 'best technology' and most economically efficient solutions and attempt to develop and encourage innovative business solutions instead of penalising emerging competitors.

An Approach to 'True Value'

The ESC proposes:

"It is the Commission's view that the true value of distributed generation is reflected by a return to investors in distributed generation that captures, as accurately as possible, the total benefits produced by that investment."

Superficially, this sounds sensible. But do other consumers also have to meet this criterion? If I invest in energy efficiency or demand management, or install a large air conditioner, do I receive or pay 'true value'?

ESC is really asking the wrong question. If there was a genuinely competitive market, one key issue would be 'what net profit could I make when exporting to a neighbour, using an alternative to the grid, relative to what the incumbent energy supply industry might pay me'?

It may be necessary to consider 'fair value' instead. Some ways of doing this could be:

- As noted earlier, look at the price at which electricity exported by a DG host is on-sold to another consumer, then deduct the legitimate costs incurred by the retailer and network

operator to deliver that electricity (with a fair profit margin) and then pay the DG host the remainder of the sale price (minus GST).

- Assess the cost the DG host would incur to deliver exported electricity to a nearby hypothetical customer and calculate a levelised long run cost of supply. The DG host could then be paid the difference between the estimated sale price and the hypothetical cost of exporting it independent of the grid. One potentially low cost method of 'exporting' electricity would be to charge up a battery, then move the battery to the buyer's site (eg by simply sliding it through a hole in the fence). Another option would be to use an electric vehicle as 'portable storage' to transfer electricity. This could be cheaper than installing cables and meeting safety and other requirements.
- Allow third parties to make offers to deliver the electricity to selected customers.
- Consider all the long term societal costs and benefits of reducing greenhouse gas emissions, increasing economic growth and employment, reducing pollution, etc. These could be compared with the social benefit of private retailers and network operators gaining revenue (the profits from which may be sent overseas, while tax minimisation strategies may be used). Some estimates of the social cost of carbon are very high, in the hundreds of dollars per tonne of avoided emissions: if such a value was applied, it may justify a strong government-driven program to cut emissions from electricity, despite costs to retailers and network operators.

A fundamental issue ESC faces is that our electricity market model is based on an incorrect assumption that electricity networks are 'natural monopolies'. In reality, they compete with a wide range of alternatives to deliver services to consumers (at least at the margin) as discussed earlier.

The CoAG guidelines (2007) state:

> "As far as possible, restrictions on competition should be avoided or minimised."

There has been no recent analysis of the assumption that electricity networks are 'natural monopolies' and the impacts on competition of the regulatory model applied to them. Recent technology developments, including Distributed Generation, challenge this assumption. While it may be beyond the scope of this Inquiry, this is an urgent issue that requires attention, as there have been many examples where network operators seem to have used their market power to limit competition from emerging alternatives such as cogeneration and rooftop solar, as well as applying high fixed charges that dilute price signals to consumers. I suggest the ESC refer to articles by Nigel Morris that provide examples of the distortions now being created by incumbent electricity suppliers. Such distortions must be addressed if DG and other emerging energy service options are to be properly considered. See http://solarbusiness.com.au/how-the-electricity-industry-is-blocking-solar-in-australia-part-1/ and http://solarbusiness.com.au/how-the-electricity-industry-is-blocking-solar-in-australia-part-2/

And DG must be treated fairly relative to the range of alternatives. For example, a consumer can choose to switch to or from gas cooking or hot water, or install a big air conditioner without paying the electricity retailer or network operator anything. So why should the benefit to a DG host be tied to its impacts on costs of the retailer and network operator?

Network operators have been given a false sense of entitlement to a 'right to make a profit', regardless of their past poor judgement regarding investment in infrastructure. There is a risk that the ESC's approach to this Inquiry will reinforce that misguided sense of entitlement.

Additional benefits of DG

It is quite remarkable that the ESC states in its discussion paper (p.v) that:

"The Commission has so far been unable to identify specific environmental or other public benefits that a distributed generator provides to the distribution network, that are easily quantifiable."

First, this implies the ESC has wrongly concluded that benefits analysed must be captured by the distribution network. In reality, the focus should be on overall benefit to society and consumers, not distributors. This reflects a serious case of 'regulator capture'. Second, it suggests the ESC has not tried very hard to identify broader societal benefits.

This statement raises questions about the capacity of the ESC to conduct this Inquiry in a balanced manner.

The Objective in the ESC Act is clear. Its task is to 'promote the long term interests of Victorian consumers'. Distributors should be viewed as just one of many potentially affected groups. Policy should consider impacts on each group within the broader societal context, as the CoAG Guidelines referred to earlier in this submission make clear. As also noted earlier, the ESC act creates barriers to the ESC carrying out its objective, by constraining its focus.

The following outlines some of the societal benefits of DG (and other emerging energy service solutions outlined earlier).

Decarbonisation of electricity and emission reduction from lower electricity use

This is a key focus of most people and businesses that invest in DG.

Estimating the social value of emission abatement is complex and, in the case of some technologies, owners receive some benefit from the Small Scale Renewable Energy Target, in the form of payment for deemed abatement over 10 to 15 years at a rate of around $40/MWh. In reality, PV systems have much longer lives, and the Clean Energy Regulator uses a conservative assumption of PV output. So the real STC price per MWh generated may be more like half of this.

The original primary objective of the RET was to drive development of the renewable energy industry: emission reduction is a secondary outcome. So only part of the STC (or LGC) price should be seen as an incentive for emission abatement. Indeed, the RET has provided substantial economic development and industry restructuring benefits, as well as reducing the wholesale electricity price for all consumers. The ESC must be careful about suggesting that some or all of the STC price reflects payment for the decarbonisation effect of DG.

Governments are also prepared to pay a carbon price for a range of specified activities under the national Emission Reduction Fund (around $13/tonne of CO2e avoided) and the Victorian Energy Efficiency Target (at present about $19/tonne of CO2e avoided). These provide benchmarks for valuation of the abatement value of DG.

However, these schemes are limited by the politics of their creation, so they do not reflect the full value of abatement. A more comprehensive approach would be to consider the social cost of carbon abatement, a topic that has been extensively explored by analysts. Table 1 shows a range of estimates of the social cost of carbon from the US EPA, based on varying assumptions and over time.

Table 1. Social Cost of CO_2, 2015–2050 [a] (in US 2007 Dollars per metric ton CO_2) from http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html

Source: Technical Support Document (PDF, 21 pp, 1 MB): Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013, Revised July 2015)

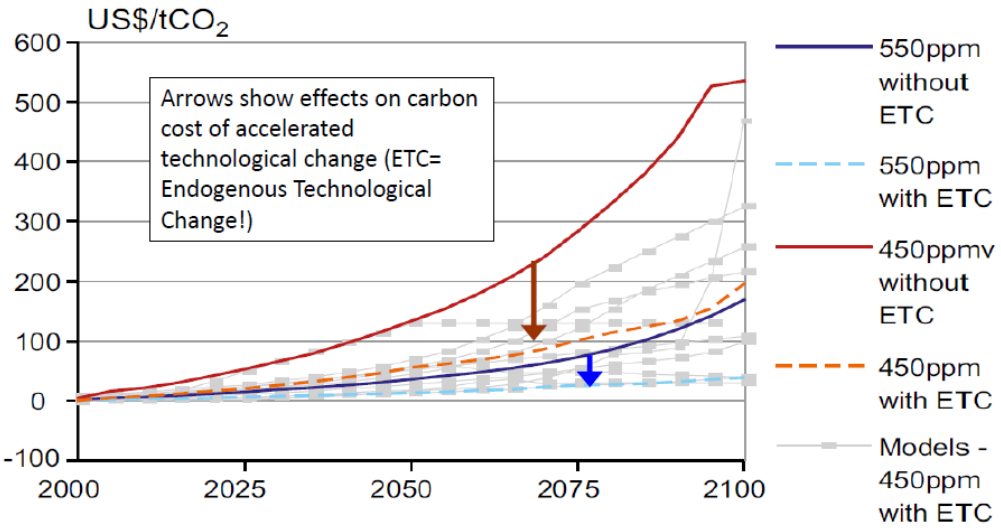
	Discount Rate and Statistic			
Year	5% Average	3% Average	2.5% Average	3% 95th percentile
2015	$11	$36	$56	$105
2020	$12	$42	$62	$123
2025	$14	$46	$68	$138
2030	$16	$50	$73	$152
2035	$18	$55	$78	$168
2040	$21	$60	$84	$183
2045	$23	$64	$89	$197
2050	$26	$69	$95	$212

Note [a] The SC-CO_2 values are dollar-year and emissions-year specific.

Other studies, such as this one, (http://news.stanford.edu/news/2015/january/emissions-social-costs-011215.html) suggest higher prices are justified. In this case, a social carbon cost of US$220/tonne for emissions in 2015 is considered appropriate by the authors.

It should also be noted that most economic modelling proposes that the carbon price will increase over time, as lower cost abatement measures are captured. However, active policy to drive abatement technology development and adoption can reduce the carbon price needed to drive a given level of abatement, through capture of economies of scale, innovation effects and 'learning by doing'. This has been seen as renewable energy and energy efficiency costs have declined over the past few years, and is reflected in Figure 2.

Figure 2. Range of future costs of emission permits for 450 and 550 ppm scenarios showing impact of accelerating technological change – average of 9 models (IPCC WG3 Contribution to 4th Assessment Report, Cross-sectoral chapter, Barker et al (2007)



This effect has been seen in carbon trading schemes such as the EU scheme and the Clean Development Mechanism market for CERs. Prices have been well below predictions because of lower than expected abatement costs driven by the above factors, and a combination of economic factors.

So, as part of the estimation of the 'true value' of DG, zero and low emission carbon DG should be given a credit for their long term effect of reducing the social cost of carbon below what would otherwise be expected. The data shown in Table 1 and Figure 2 provide an initial range of values for such a credit.

Energy sector factors

The growth of DG drives a number of savings that potentially flow to all consumers over the long term. These include:

- Downward pressure on wholesale electricity prices. This has been demonstrated to be significant by a number of studies in the recent commonwealth government review process. Incorporating storage and smart management into an integrated DG package would further enhance this effect
- Reduction of insurance costs for network providers in fire-prone regions: by either replacing power lines, or allowing power lines in high risk areas to be shut down at times of high fire risk, insurance costs should be reduced, as well as costs of community recovery from fires caused by power lines (reflected in individual home and business insurance premiums)
- Reduced exposure to safety risk of fire fighters and residents in fire-prone regions
- Improved system reliability and lower maintenance costs. DG can reduce peak pressures on networks. Where storage is included, it assists with management of maintenance activity by increasing the flexibility for scheduling of repairs by allowing consumers to continue to receive energy services while faults exist.
- Where equipment is appropriately designed and managed, ancillary benefits can be provided, such as voltage stabilisation.

Economic benefits

Recent studies by ClimateWorks (2015) and the Australian Alliance for Saving Energy (A2SE, 2014) have shown that measures that improve 'energy productivity', including DG, can contribute to a higher rate of economic growth. A2SE (page 5) suggest that doubling energy productivity by 2030, to which DG is a significant contributor, would increase Australia's GDP by 2.2%.

DG contributes to economic development in a number of ways, including:

- Higher employment intensity, more diverse range of skills, wider geographical distribution than in the conventional energy sector
- Different profile of capital requirements, as DG begins to deliver a revenue stream after a short installation process, costs are spread over time and risks are spread by large numbers of small projects, lower risk due to diversity. Much DG capital is provided by 'retail' capital providers, which drives increased activity in that sector
- Lower overall energy costs that free up funds for investment in other sectors of the economy
- Driving innovation that improves economic productivity, as reflected in Figure 2, through economies of scale, 'learning by doing', technological and business model innovation

As noted, several studies have evaluated the economic benefits of actions including DG. For example, in a 2014 report the International Energy Agency suggested that, for businesses, the 'multiple benefits' of energy efficiency measures could be as high as 2.5 times the value of the direct energy savings. DG and storage may provide similar or even greater benefits. While it may be argued that this is a 'private benefit', it also impacts on economic growth and electricity prices for all consumers.

Economic models are still not well-suited to analysing the full benefits, due to their diversity and subtlety. Nevertheless, preliminary estimates can be made, sensitivity studies carried out and recommendations made for further work.

Health and other externalities

It is surprising that ESC seems to have been unable to find analysis of these issues on which to base its work. There is an extensive literature in this area.

A useful report that provides a starting point is the Australian Academy of Technological Sciences and Engineering 2009 paper, *The Hidden Costs of Electricity: externalities of power generation in Australia*. ATSE suggest an externality cost (excluding carbon) of around $13/MWh for coal powered generation and $1.50-5 for renewables. However, given the age of some of our power stations, this may be higher.

Additional insights may also be provided by review of the costs related to recent mine fires and mine wall collapses in the Latrobe Valley.

Doctors for the Environment Australia (http://dea.org.au/) have strong interest in energy and climate-related health impacts, and may also be able to assist ESC in identifying relevant research and analysis.

An emerging aspect of the external costs of electricity generation is the concerns about the long term economic, social and environmental impacts of coal seam gas extraction. Where this is the marginal source of gas for power generation now or in the future, or where DG may replace on-site use of gas sourced from CSG, related long term costs and impacts are relevant.

Facilitating capture of future benefits

We are in a time of rapid change in the energy services sector. While this creates increased risk for many participants, it also means that active support for emerging energy solutions can offer long term benefit for consumers – consistent with the ESC Act Objective.

This is a challenge for policy makers in the energy sector, who have a history of being 'gatekeepers' and defining their role as protecting consumers and the incumbent industry from risk associated with change. This has effectively led to discrimination against emerging energy solutions.

But if we are to capture the benefits of change, we need to facilitate change. This means, at a minimum, providing a level playing field. Where it is not possible to roll back existing distortions or manage the market power of incumbents, 'second best' solutions are justified, so new competitors are subsidised or supported in other ways to offset the impact of the existing circumstances.

Where there is evidence that new options are likely to improve on present outcomes, there is a case for government to assist early stage development and roll-out. Professor Garnaut, in his 2008 climate policy study, acknowledged a role for government in RDD&C because of spillover effects: no single business can capture the full benefits of innovative solutions, as others can learn from their

experience and take advantage of capacity developed by innovators. This provides a rationale for subsidies or other assistance.

So ESC needs to consider the broader market context when assessing the need to evaluate the 'true value', not just in today's conditions, but in foreseeable future circumstances. We know the urgency of emission reduction can only increase and the social cost of carbon will reflect this. We also know that new technologies and business models will drive lower costs for consumers over time, as they capture economies of scale and the lessons of experience.

So ESC judgements about 'overpaying' DG hosts must be carefully evaluated: they may qualify as effective incentives to overcome existing market distortions and/or accelerate innovation that provides long term net benefit to consumers.

Critique: ESC criteria to determine energy and network value of DG

On page 6 of the discussion paper, the ESC outlines its criteria for assessing the energy and network value of DG. These include:

- Materiality: if the work involved in calculating the benefits to a DG host are small, 'there is little to be gained from the effort'.
- Simplicity: conversion of the benefits into 'a payment structure that is simple to understand (and administer) by all relevant market participants
- Behavioural response: benefits identified must be 'readily convertible into a payment structure that signals or drives the appropriate behavioural response – namely investment in distributed generation where and when it is needed'

These are laudable criteria. But we need to ask how well existing tariffs, charges and market operation meet them, before applying them to one emerging category of energy service delivery. Not many consumers would agree that the present situation meets these criteria. So why should DG be singled out? We need a level playing field or even a playing field tilted in favour of DG.

Materiality

Effectively, the ESC is saying it will make judgements about the likely significance of factors that may affect the 'true value' of DG and, if they seem small, implying that it will ignore them. This seems to be an example of application of the Pareto Principle.

On what basis does ESC decide which issues are significant? In my work on energy efficiency I have seen many examples of professionals making judgements about factors being trivial, only to find that they are significant when analysed in detail, or that, over time they may become significant.

I am not confident that the ESC is in a position to fairly judge the significance of many aspects of DG. The reality is that costs, performance and capability of DG options (and energy efficiency, demand management etc) are evolving rapidly, and new business models are reframing the costs and ease of adoption. In many cases, not even the clean energy industry can predict the changes!

Sensitivity analysis, life cycle analysis, and assessments of possible cost, technology and business trends need to be factored into judgements on materiality.

Simplicity

The ESC seems to be stating that any costs or benefits relating to the 'true value' of DG *must* be able to be delivered using simple payment mechanisms. This is a serious constraint on any comprehensive evaluation of 'true value'. And this criterion is clearly not met by existing pricing

structures. The estimation of 'true value' must be separated from consideration of how, and to what extent that value can best be delivered to DG hosts and/or other beneficiaries. They are separate issues. In practice, there are many mechanisms available to transfer value, including:

- A component of a time of use, locational FiT price
- Adjustment to fixed charges or demand charges
- Separate payments (one-off or at intervals) to those who contribute 'value'
- Creation of a fund that can allocate money based on agreed principles
- Insurance mechanisms, such as the TAC third party insurance scheme

A wide variety of mechanisms can also be used to manage potential costs and risks associated with adoption of DG and other emerging energy service solutions, including facilitating financing, support for RDD&C, spreading risk, etc. Managing costs and risks of DG and other emerging options is just as important as allocating the value of benefits.

The policy reality often involves applying economic 'second best' solutions when it is not practical to implement ideal policy responses.

Behavioural response

This is a desirable feature for DG. However, while the incumbent electricity industry is allowed to undermine signals for behavioural response by charging high fixed fees, charging for the capacity of connections instead of actual demand, and requiring excessively complex and time consuming processes to be followed, it seems grossly unfair to make this a requirement for DG.

It is desirable that mechanisms for management of DG meet this criterion, but it must not be mandatory. It may well be that fixing existing distortions or controlling misuse of market power by incumbent firms is necessary before addressing DG. Further, it may be necessary to apply 'economic second best' solutions, at least on a temporary basis, until more fundamental market distortions have been addressed. This may even involve subsidising emerging energy service options to compensate for the impact of existing market distortions.

Conclusion

The approach to evaluation of the 'true value' of Distributed Generation proposed by the ESC requires a major review if it is to meet the intent of the government, which seems to be to finally resolve the debate over perceptions of discriminatory treatment of DG hosts.

Indeed, it may be that the ESC is an inappropriate agency to conduct such an Inquiry. The constraints on ESC capabilities due to the ESC Act and consequent selection of staff skills add to this concern. The discussion paper also highlights the ongoing cultural problems across energy policy makers and regulators, and even governments: their focus reinforces a misplaced sense of 'entitlement' within the electricity industry by focusing on impacts on the incumbent industry instead of long term benefits of consumers. This issue was emphasised by the Productivity Commission in its 2013 Inquiry, where it concluded that energy policy makers and regulators were not focused on a key dimension of the National Electricity Objective: long term consumer benefit.

At a minimum, the Victorian government needs to revise the objectives of the ESC Act, and to expand the capabilities and accountability of the ESC.

The Victorian government also needs to revise the Terms of Reference of this Inquiry, to allow consideration of the allocation of revenue from on-selling of electricity exported by DG hosts, and to emphasise its focus on long term benefits for consumers – and society.